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CSES Planetary Science Lecture Series

Nina Lanza

LANL, ISR-2

Oxidation of Manganese at Kimberley, Gale Crater: More Free Oxygen in Mars' Past?

Thursday, August 25, 2016

10:00 AM

Quantum Conference Room

(TA-03, Bldg 0040, Room N101)

Abstract. Recent results from the ChemCam instrument on the Curiosity rover has discovered high concentrations of manganese in rocks in Gale crater, some of which are inferred to be Mn-oxide minerals. On Earth, manganese deposits provide unique indicators of water-rich environments and their redox states because very high-potential oxidants are required to oxidize Mn to insoluble, high-valence oxides, much higher than those needed to oxidize Fe or S. Consequently, Mn-rich rocks on Earth closely track the rise of atmospheric oxygen. Given the association between Mn-rich rocks and the redox state of surface environments, observations of anomalous Mn enrichments on Mars raise similar questions about redox history, solubility and aqueous transport, and availability as a metabolic substrate. Some of the high Mn present in Gale crater occurs in the form of fracture-filling Mn-oxide veins that crosscut sandstones in the Kimberley region. Our results suggest that the fluids moving along Kimberley fractures were in at least partial contact with the atmosphere and that the atmosphere contained sufficient amounts of O_2 to oxidize Mn. Based on the strong association between Mn-oxide deposition and evolving atmospheric dioxygen levels on Earth, the presence of these Mn phases on Mars suggests that there was more abundant molecular oxygen within the atmosphere and some groundwaters of ancient Mars than in the present day.

Biography. Nina Lanza is a Staff Scientist at Los Alamos National Laboratory in the Space and Remote Sensing group (ISR-2). She was educated at Smith College (BA, Astronomy), Wesleyan University (MA, Earth and Environmental Sciences), and the University of New Mexico (PhD, Earth and Planetary Sciences). She is currently living her dream of working on a spaceship with lasers on Mars as part of the ChemCam instrument team on the Curiosity rover. Nina is broadly interested in understanding the history of water on Mars and the potential for life in martian environments. Her most recent work focuses on manganese in the martian environment and its implications for habitability and biosignatures.

For more information, contact the technical host, Reiner Friedel, 665-1936, rfriedel@lanl.gov.

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